

APPENDIX H

WSR-88D OPERATIONS PLAN FOR TROPICAL CYCLONE EVENTS

The following procedures are used to modify WSR-88D operations in support of the tropical cyclone warning system:

At the Unit Control Position (UCP):

1. Operational mode--precipitation mode. Either **VCP 11** (14 elevations in 5 minutes) **or VCP 21** (9 elevations in 6 minutes). VCP 21 will cause less wear on antenna gearing, and offers reduced potential for loadshedding. For convection within 80 nm of the radar, VCP 11 offers denser vertical resolution above tilt 5 and is thus preferred for close-in cases and overpasses.
2. Velocity data levels (display levels) for the 8-data level products should be set to display hurricane-force winds. Note that default settings, which display a maximum of 64 kt, will be exceeded by even a minimal category one hurricane.

UCP commands: **SE, WXMAN1, VE** (enter appropriate menu)

then **D, 5** <--display Table 5 first
then **M** (modify Table 5)
suggested values are -100, -80

then **E** (save edits)
then **D, 7** <-- now display Table 7
M (modify Table 7)
suggested values are -135, -115

then **E** (save edits)

This modifies the 8-level products ONLY. The routine 16-level products are not affected. By entering the negative values above, corresponding positive values are automatically supplied. Table 5 will be used if the velocity increment is 1 kt (0.97 kt or 0.5 m/s) while Table 7 will be used if the velocity increment is increased to 2 kt (1.94 kt or 1 m/s). See paragraph 3 below.
Note: These are good initial settings for pre-event preparedness. As the hurricane comes into radar range, examine the velocities in the eyewall. Settings (as time allows) may be adjusted by 5 or 10 kt increments to produce a clean maximum (a 'bulls-eye') in the area of the velocity maximum. This velocity maximum is usually found on the right side of the eyewall (right side defined as standing behind the hurricane and looking forward along the direction of motion).

3. If velocities are expected to exceed 124 kt, increase the velocity increment from 1 to 2 kt.

UCP commands: **RD, PR** (turn off auto pulse repetition frequency (PRF))
V (display current VCP)
V, 1.94 (switch velocity measurement increment (VMI) of current VCP)
E (save edits)
RD, DO, 0 (download modified VCP)
RD, PR (turn on auto PRF)

Note: If the velocity increment is 1 kt, Table 5 above applies; if the velocity increment is 2 kt, Table 7 above applies.

4. Allow non-associated Principal User Processors (NAPUP) (e.g. TPC/NHC) access to:
 - a. 8-data level Velocity product (product #24).
 - b. 0.54 nm Composite Reflectivity product (product #37).

These may be added to the Generation and Distribution Control list, Adaptation list 'A,' with a 'Y' in the NAPUP column. (Note: SRM, product #56, should already appear with a 'Y' for NAPUP.

UCP commands: **AD, WXMN1, G, A**
 then **M, 9** (modify line 9)

		AUT	AUT	STO	NA
SLICE	GEN ARC	STO	TIM	PUP	
-2.0	1	0	1	60 Y	(con't)

then **M, 22** (modify line 22)

		AUT	AUT	STO	NA
SLICE	GEN ARC	STO	TIM	PUP	
	1	0	1	60 Y	

then **E** (save edits)
G, R, A (replace current list with copy of changes)
G, E (save edits)

5. Make certain that Archive II is active.
6. If range-folding is obscuring velocities beyond about 70-80 nm, shown in extreme cases as a solid purple band surrounding the 'good' velocities, auto-PRF is not working effectively. Consider turning auto PRF **off**. Auto PRF uses only the 4 highest PRFs (5 through 8). To alleviate the purple band problem and extend the range of usable velocities, set PRF to PRF #4.

UCP commands: **RD, PR** (turn off auto PRF)
F1 (return to main menu)
V (enter VCP menu)
S, 94 (set Rmax to 94 nm)
E (save edits)
then **F1** (return to main menu)
RD, DO, 0 (down load the modified VCP)

To return to normal: **RD, PR** (turn auto PRF back on)

7. Applications terminal, associated PUPs (APUP):

a. Suggested minimum routine product set (RPS) lists follow these instructions. Sites may wish to add Mesocyclone (M), Tornadic Vortex Signature (TVS), Storm Tracking (STI), and Echo Tops (ET) to the list. Storm Relative Velocity products (SRM, SRR) should be generated as One-Time Requests, with storm motion determined by the forecaster. The system software may not be able to produce a useful motion due to the rotation of the tropical cyclone. One-Hour Precip (looped) can also be useful in finding the tropical cyclone center in poorly defined cases.

b. Initiate a local product archive (Archive IV). This will copy the PUP database onto the optical disk for later assessment. This record has proven to be extremely useful even if Archive II is also running and can become crucial if Archive II fails.

*Most important here, for both APUPs and NAPUPs, is the **8-data level velocity product**, and, in the event of velocities exceeding 124 knots, changing the **velocity increment from 1 to 2 knots**.*

The advantage of using the 8-level velocity product is that the location of strong hurricane force winds can be displayed, while leaving the standard 16-level velocity product (-64 kt to +64 kt) for display of surrounding areas. The data resolution (i.e., "width" of the display levels) is maintained to aid identification of mesocyclones which may occur in rainbands.

Note that the key 8-level velocity product and the 0.54 nm composite reflectivity product are not available to non-associated users (e.g. TPC) by default, although some stations may already have granted access. These products can be made available to NAPUPs by inserting them into the Generation and Distribution Control list. Ideally, this amendment to the distribution list would be done in anticipation of an event, so that everything is ready to go should a hurricane approach. Again, local Unit Radar Coordinator approval should be sought as necessary--in advance--so that the change can be made operationally as the need arises.

Additional note: For improved WSR-88D algorithm performance during tropical cyclone events, the Threshold Pattern Vector (TPV) adaptable parameter for the Mesocyclone algorithm should be reduced to improve detection of small diameter features. From the main menu:

UCP commands: **AD, *****, M, *****, M** (display the mesoscale adaptable parameter menu)

change **TPV** (page forward to page 2) to **6**
then **E** (save edits)

The default Z-R relationship does not perform well in tropical cyclones. Change the default Z-R ($300R^{1.4}$) to the tropical Z-R, ($250R^{1.2}$) to provide better precipitation estimates.

From the main menu:

UCP commands: **AD, *****, M, *****, Z** (display Z-R parameters)

then change **CZM** to **250**

and change **CZP** to **1.2**

then **E** (save edits)

Table H-1. Suggested minimum WSR-88D RPS lists for tropical cyclones.

Tropical cyclone range > 124 nm

<u>Product</u>	<u>Elevation angle</u>	<u>Data resolution</u>	<u>Data levels</u>
Base Reflectivity	0.5°	1.1 nm	16
	1.5	1.1 nm	16
	0.5	0.54 nm	16
	1.5	0.54 nm	16
	2.4	0.54 nm	16
	3.4	0.54 nm	16
Base velocity	0.5	0.54 nm	16
	1.5	0.54 nm	16
	2.4	0.54 nm	16
	0.5	0.54 nm	8
Composite Reflectivity		0.54 nm	16

VIL, Storm Total Precip

Tropical cyclone range 62 - 124 nm

<u>Product</u>	<u>Elevation angle</u>	<u>Data resolution</u>	<u>Data levels</u>
Base Reflectivity	0.5°	1.1 nm	16
	0.5	0.54 nm	16
	1.5	0.54 nm	16
	2.4	0.54 nm	16
	3.4	0.54 nm	16
	6.0	0.54 nm	16

Base velocity	0.5	0.54 nm	16
	1.5	0.54 nm	16

<u>Product</u>	<u>Elevation angle</u>	<u>Data resolution</u>	<u>Data levels</u>
Base Velocity	2.4	0.54 nm	16
(con't)	3.4	0.54 nm	16
	0.5	0.54 nm	8

Composite Reflectivity		0.54 nm	16
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VIL, Storm Total Precip

Tropical cyclone range > 32 - 62 nm

<u>Product</u>	<u>Elevation angle</u>	<u>Data resolution</u>	<u>Data levels</u>
Base Reflectivity	0.5°	1.1 nm	16
	0.5	0.54 nm	16
	1.5	0.54 nm	16
	2.4	0.54 nm	16
	4.3	0.54 nm	16
	6.0	0.54 nm	16

Base velocity	0.5	0.54/0.27 nm	16
	1.5	0.54/0.27 nm	16
	2.4	0.54 nm	16
	4.3	0.54 nm	16
	0.5	0.54 nm	8

Composite Reflectivity		0.54 nm	16
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VIL, Storm Total Precip

Tropical cyclone range 0 - 32 nm

<u>Product</u>	<u>Elevation angle</u>	<u>Data resolution</u>	<u>Data levels</u>
Base Reflectivity	0.5°	1.1 nm	16
	0.5	0.54 nm	16
	1.5	0.54 nm	16
	2.4	0.54 nm	16
	3.4	0.54 nm	16
	6.0	0.54 nm	16
	9.9	0.54 nm	16

<u>Product</u>	<u>Elevation angle</u>	<u>Data resolution</u>	<u>Data levels</u>
Base velocity	0.5	0.54/0.27/0.13 nm	16
	1.5	0.54/0.27 nm	16
	2.4	0.54 nm	16
	0.5	0.54 nm	8
	1.5	0.54 nm	8

Composite Reflectivity	0.54 nm	16
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VIL, Storm Total Precip
